

Transformation of lead into pyromorphite by fungi

YOUNG JOON RHEE^{1*}, STEPHEN HILLIER², AND

GEOFFREY M. GADD¹

¹Division of Molecular Microbiology, College of Life Sciences, University of Dundee, Dundee DD1 5EH, Scotland, UK, y.j.rhee@dundee.ac.uk (*presenting author), g.m.gadd@dundee.ac.uk

²The James Hutton Institute, Craigiebuckler, Aberdeen AB15 8QH, Scotland, UK, Stephen.Hillier@hutton.ac.uk

Introduction

Lead is a serious environmental pollutant in all its chemical forms. Attempts have been made to immobilize lead in soil as the mineral pyromorphite using phosphate amendments (e.g. rock phosphate, phosphoric acid and apatite [1-2]). Lead metal, an important structural and industrial material, is subject to weathering, and soil contamination also occurs through hunting and shooting. Although fungi are increasingly appreciated as geologic agents [3-5], there is a distinct lack of knowledge about their involvement in lead geochemistry. We examined the influence of fungal activity on lead metal and discovered that metallic lead can be transformed into chloropyromorphite, the most stable lead mineral that exists. This is of geochemical significance, not only regarding lead fate and cycling in the environment but also in relation to the phosphate cycle and linked with microbial transformation of inorganic and organic phosphorus. In this contribution, we provide the first report of mycogenic chloropyromorphite formation from metallic lead and highlight the significance of this phenomenon as a biotic component of lead biogeochemistry, with additional consequences for survival in lead-contaminated environments and bioremediation treatments for lead-contaminated land.

Conclusion

The results from present study clearly demonstrate a previously unknown biogenic step in the biocorrosion of lead metal and transformation into pyromorphite through fungal action. This discovery represents an addition to our understanding of the biogeochemical cycling of lead, as well as phosphorus, and the importance of fungi as agents of geochemical changes (Rhee, Y.J., Hillier, S., and Gadd, G. M. (2012). Lead transformation to pyromorphite by fungi. *Current Biology*, doi:10.1016/j.cub.2011.12.017).

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Chemical zoning in calc-silicate rocks: stratigraphic control versus metasomatism (Northern Portugal)

MARIA AREIAS¹, MARIA A. RIBEIRO^{1*}, ARMANDA DÓRIA¹³

¹Centro Geologia Universidade Porto, DGAOT-FCUP, R. Campo Alegre, 4169-007 Porto, Portugal (* presenting author: maribeir@fc.up.pt)

Introduction

In a sheared gneiss-migmatite massif, in the border of a sin-tectonic variscan granite (coastal area of NW Portugal), metatexites and diatexites occur associated with metapelitic and calc-silicate rocks. Calc-silicate resistors (decimetric to metric bodies) are abundant mostly in the metatexitic zones, with ovoid or ellipsoidal geometry resulting from stretching and boudinage, associated with the shear foliation. The calc-silicate bodies are sub-parallel to the migmatitic foliation, striking N20° to N160°, with sheet folds [1].

Results and conclusion

The calc-silicate nodules present an internal structure with three zones: (i) core zone (CZ) with $Wo+Cpx+Cal+An+Qtz+Sph+/-Ep+/-Clzo$; (ii) intermediate zone (IZ) where amphibole occurs and clinopyroxene disappears, and (iii) an external zone (EZ) with $Bt+Qtz+Plg_{An50+}/ilm$. Taking into account field, petrographic and geochemical data, the IZ may be the result of mass transfer processes between different protoliths, coeval with de metamorphism, migmatization and deformation: the CZ represents a metagreywacke, with some carbonate concretions; the EZ a metapsamite and the IZ represents the metasomatic edges of the CZ. The chemical composition of the three zones is consistent to this explanation. In relation to the CZ, the IZ is richer in Na, K, Fe, Mg, P, LILE, Sc, Nb and Ta. In relation to the IZ, the EZ is enriched in Na and LILE and has less concentration at HSF and transition metals. With support in these data it is considered that the IZ has input from the EZ (Mg, Fe, Na, K, P, LILE, Sc, Nb and Ta) and from CZ (HSF). The geometry, internal structure, petrographic and geochemical composition of the calc-silicate boudins points to a model of diffusional metasomatism promoted by chemical potential between the CZ and the EZ - boundary metasomatism [2].

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